



Forest Health Protection

Pacific Southwest Region

Northeastern California Shared Service Area

Date: September 23, 2015

File Code: 3420

To: District Ranger, American River Ranger District, Tahoe National Forest

Subject: Evaluation of western pine beetle activity in the Sugar Pine Reservoir area (FHP Report NE15-10)

At the request of Kelly Pavlica, Silviculturist, American River Ranger District, Tahoe National Forest, I conducted a field evaluation of proposed thinning treatments within the Sugar Pine Reservoir area on September 23, 2015. The objectives of the visit were to evaluate western pine beetle (*Dendroctonus brevicomis*)-caused ponderosa pine mortality, current stand conditions and discuss treatment alternatives. Kelly Pavlica and Mark Brown accompanied me in the field.

Background

The Sugar Pine Reservoir area is located about 11 miles NE of Foresthill, CA at elevations ranging between 3800 and 4500 feet (approx. 39° 09' 12.4"N and 120° 45' 22.6"W). Portions of the Volcano ponderosa pine (*Pinus ponderosa*) plantation, established after the 1960 Volcano Fire, also occur in this area in addition to natural stands. Annual precipitation is approximately 60 inches. Long-term management objectives for this area are to reduce stand density, increase tree species diversity in plantations and use prescribed fire to maintain desired fuel loadings.



Figure 1. Dense group of ponderosa pine killed by western pine beetle near Sugar Pine Reservoir. Photo: K. Pavlica.

Observations

Average stand density within most of the proposed treatment areas is well above recommended levels that would reduce the risk of successful western pine beetle attacks in ponderosa pine

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stands. In fact, many of these stands are at extreme risk of bark beetle-cause mortality. Sample plots revealed 260 to 420 sq.ft./acre of basal area. This is close to three to four times the density that is desired for healthy ponderosa pine stands.

Western pine beetle-caused ponderosa pine mortality is increasing within this entire area as group killing of pole and sawtimber sized ponderosa pine was observed in several locations (Figures 1 - 3). Most of this mortality has occurred over the past two years. In 2014, there were 14 separate groups of ponderosa pine mortality in the general area ranging from 2 to 20 dead trees. Most of these groups were < 1 acre. Mortality greatly increased in 2015 to 56 separate groups ranging from <1 to 36 acres with 1 to 12 dead trees/acre (Region 5 Aerial Detection Survey 2014 and 2015[draft report]) (Figure 3). The 2015 aerial survey data was collected in July 2015 and based on field observations during this site visit, tree mortality has increased significantly over the past two months.



Figure 1. Dead and dying ponderosa pine near Sugar Pine Reservoir. Trees that died earlier in 2015 have orange foliage. Trees that died in September 2015 have yellow foliage. Photo: M. Brown



Figure 2. Dead and dying ponderosa pine within the Sugar Pine Reservoir campground. Photo: M. Brown

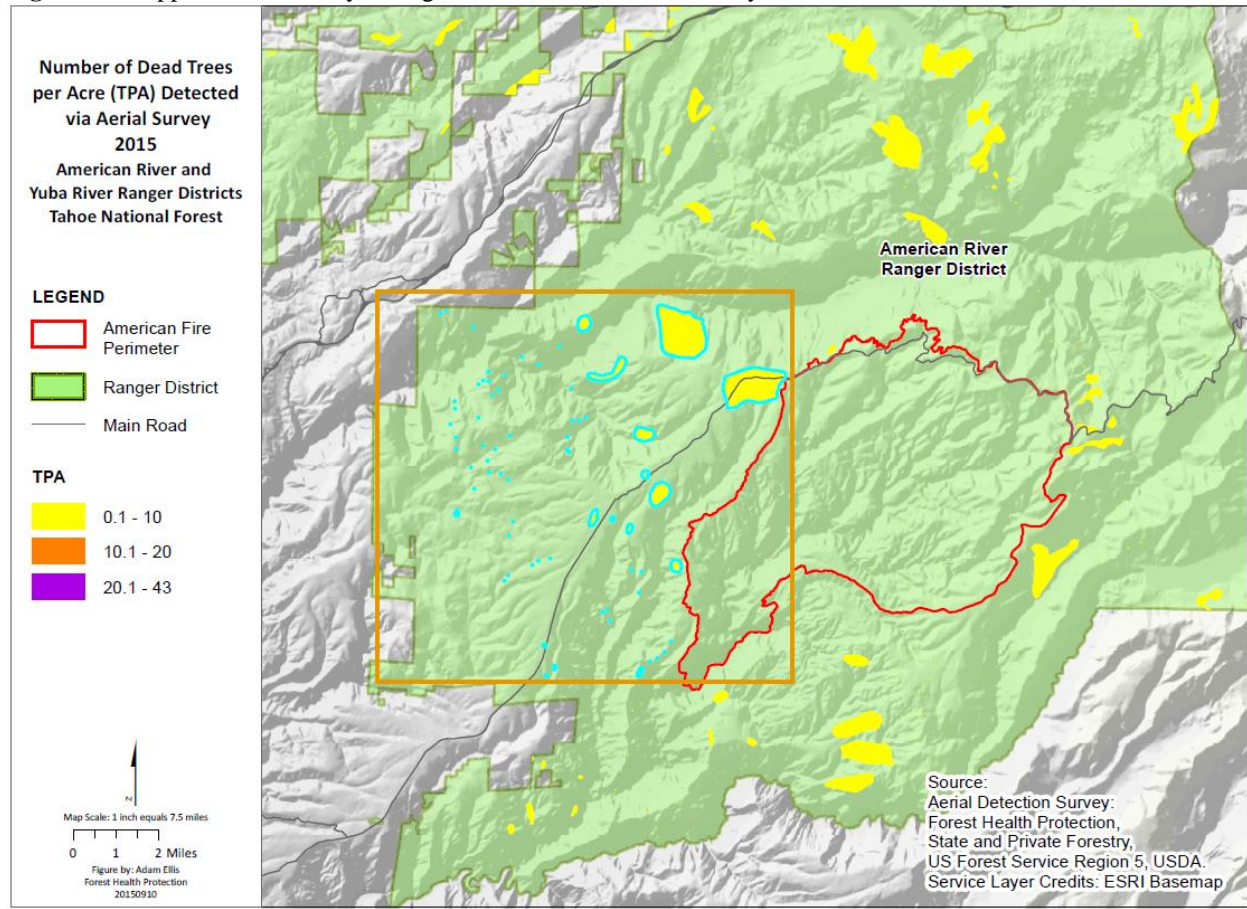
Discussion

High stand density combined with drought conditions cause extreme moisture stress in individual trees, thus reducing their ability to fend off bark beetle attacks. Healthy ponderosa pines defend themselves by producing resins that drown attacking beetles. When trees are stressed, resin pressure is reduced and the probability of successful bark beetle attack is increased. High stand density may also improve conditions for the bark beetle pheromone communication system, which facilitates mass attacks on individual trees, by concentrating the pheromone plume under a full canopy.

Bark beetle-caused mortality has increased throughout California due in part to the extreme ongoing drought. Western pine beetle-caused mortality of ponderosa pine has also increased in many areas with higher levels of mortality occurring in overstocked stands. Dense stands of even-aged ponderosa pine are especially susceptible to bark beetle group killing during drought as was observed in the Sugar Pine Reservoir area.

Even with the mortality that has occurred here over the past two years, stand densities are still extremely high in nearly all areas and the potential exist for outbreak levels of bark beetle-caused mortality. For example, the current stand density that exists within the proposed treatment areas is well above the limiting SDI (stand density index) of 365 for ponderosa pine. SDI 365 is considered the upper management zone above which bark beetle outbreaks are likely to occur (Oliver 1995).

Figure 3. Mapped tree mortality during 2015 Aerial Detection Survey



The best strategy to decrease the amount of additional mortality in the immediate and long-term is to reduce stand density through thinning. Thinning will increase the health and vigor of residual ponderosa pines by reducing competition for limited soil moisture (Fettig et al. 2007). Opening up the canopy may also disrupt the pheromone communication system by creating convection currents and air turbulence through increases in soil temperature (Bartos and Amman 1989).

The District is proposing to reduce SDI within the Sugar Pine Reservoir treatment units to below 230. SDI 230 is the defined threshold for the zone of imminent bark beetle caused mortality. Within this zone, endemic populations kill a few trees but net growth is still positive (Oliver 1995). Thinning stands to this level will reduce the risk of additional bark beetle-caused

mortality by reducing tree competition for limited water and nutrients. This type and level of treatment is also consistent with US Forest Service, Region 5, Ecological Restoration goals.

Efforts to reduce stand density through sanitation thinning in the Sugar Pine Reservoir area could be covered under the National Environmental Policy Act (NEPA) by Categorical Exclusion #14 [36 CFR 220.6(e)(14)] *Commercial and non-commercial sanitation harvest of trees to control insects or disease not to exceed 250 acres, requiring no more than ½ mile of temporary road construction, including removal of infested/infected trees and adjacent live uninfested/uninfected trees as determined necessary to control the spread of insects or disease.*

Based on my observations of the Sugar Pine Reservoir area, and the information provided within this evaluation, it is my opinion that this project meets the criteria outlined in this categorical exclusion.

Considerations for Sugar Pine Reservoir campgrounds

Trees in the Sugar Pine Reservoir campgrounds, like most forested campgrounds, are exposed to additional stress factors that can compromise their health and vigor. Firewood collecting sometimes leads to tree wounding from hatchets and saws. Carving and chopping trunks can cause extensive cambium damage. Foot and vehicle traffic compacts soil and can damage roots. Posting public information signs at campground entrances may help increase awareness of the human impact on campground trees.

Soil compaction can predispose conifers to bark beetle attacks and subsequent mortality. Compaction can reduce the water holding capacity of the soil and suffocate roots, which limits the available oxygen that is necessary for root growth and survival. Damaged and unhealthy roots cannot provide the upper portions of the tree with the water and nutrients it requires to maintain its natural defenses. Soil compaction and associated root injury are long-term problems that may not reveal themselves until several years after the damage has occurred. In order to minimize future soil compaction and root damage, campers should be directed to specific travel corridors from campsites to restrooms, water sources, and specific recreation areas. It is especially important to divert and limit foot and vehicle travel and keep excavation for roads, trails and utilities away from the root zones of trees.

It is important to know that when cutting trees in recreation areas, all conifer stumps greater than 3” in diameter must be treated with a registered borate compound (FSM R5 Supplement 2300-92-1 modified by FSH R5 Supplement 3409.11-2010-1) to reduce the probability of infection by *Heterobasidion occidentale* and *H. irregulare*. The causal agents of Heterobasidion root disease (formerly referred to as annosus root disease).

Potential for FHP Funding

Forest Health Protection may be able to assist with funding for thinning and removing green material from overstocked areas within the Sugar Pine Reservoir area. Thinning projects in this area would meet the minimum requirements for Western Bark Beetle Program funding and are

supported by this evaluation. If you are interested in this competitive funding please contact me for assistance in developing and submitting a proposal.

If you have any questions regarding this report and/or need additional information please contact me at 530-252-6431.

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Citations:

Bartos, D.L., Amman, G.D., 1989. Microclimate: an Alternative to Tree Vigor as a Basis for Mountain Pine Beetle Infestations. RP-INT-400. U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Ogden, UT, 10 pp.

Fettig, C.J.; Klepzig, K.D.; Billings, R.F.; Munson, A.S.; Nebeker, T.E.; Negrón, J.F.; Nowak, J.T. 2007. The effectiveness of vegetation management practices for prevention and control of bark beetle outbreaks in coniferous forests of the western and southern United States. *Forest Ecology and Management*. 238: 24–53.

Oliver, W.W., 1995. Is self-thinning in ponderosa pine ruled by *Dendroctonus* bark beetles? In: *Proceedings of the 1995 National Silviculture, Workshop, GTR-RM-267*. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, C.O., pp., 213–218.

Western Pine Beetle Information

The western pine beetle, *Dendroctonus brevicomis*, has been intensively studied and has proven to be an important factor in the ecology and management of ponderosa pine throughout the range of this host species (Miller and Keen 1960). This insect breeds in the main bole of living ponderosa pine larger than about 8 inches dbh. Normally it breeds in trees weakened by drought, overstocking, root disease, dwarf mistletoe or fire. Adult beetles emerge and attack trees continuously from spring through fall. Depending on the latitude and elevation, there can be from one to four generations per year.

Evidence of Attack

Initial attacks are made about mid-bole and subsequent attacks fill in above and below. Pitch tubes are formed on the tree trunk around the entry holes. The pitch tubes are red-brown masses of resin and boring dust. Relatively few, widely scattered, white pitch tubes usually indicate that the attacks were not successful and that the tree should survive. Pheromones released during a successful attack attract other western pine beetles. Attacking beetles may spill over into nearby apparently healthy trees and overwhelm them by sheer numbers.

Life Stages and Development

These beetles pass through the egg, larval, pupal and adult stages during a life-cycle that varies in length dependent primarily upon temperature. Adults bore a sinuous gallery pattern in the phloem and the female lays eggs in niches along the sides of the gallery. The larvae are small white grubs that first feed in the phloem and then mine into the middle bark where they complete most of their development. Bluestain fungi, introduced during successful attacks, contribute to the rapid tree mortality associated with bark beetle attacks.

Conditions Affecting Outbreaks

Outbreaks of western pine beetle have been observed, and surveys made, in pine regions of the West since 1899 (Hopkins 1899; cited in Miller and Keen 1960). An insect survey completed in 1917 in northern California indicated that over 25 million board feet of pine timber had been killed by bark beetles. Information from surveys initiated in the 1930s indicates that there were enormous losses attributed to western pine beetle around that time. During the 1930's outbreak, most of the mortality occurred in stands of mature or overmature trees of poor vigor (Miller and Keen 1960). Group kills do not typically continue to increase in size through successive beetle generations as is typical with Jeffrey pine beetle. Rather, observations indicate that emerging beetles tend to leave the group kill area to initiate new attacks elsewhere.

The availability of suitable host material is a key condition influencing western pine beetle outbreaks. In northeastern California, drought stress may be the key condition influencing outbreaks. When healthy trees undergo a sudden and severe moisture stress populations of western pine beetle are likely to increase. Healthy trees ordinarily produce abundant amounts of resin, which pitch out attacking beetles, but when deprived of moisture, stressed trees cannot produce sufficient resin flow to resist attack. Any condition that results in excessive demand for moisture, such as tree crowding, competing vegetation or protracted drought periods; or any condition that reduces that ability of the roots to supply water to the tree, such as mechanical damage, root disease, or soil compaction, can cause moisture stress and increase susceptibility to attack by the western pine beetle. Woodpeckers and predaceous beetles are natural control agents when beetle populations are low.